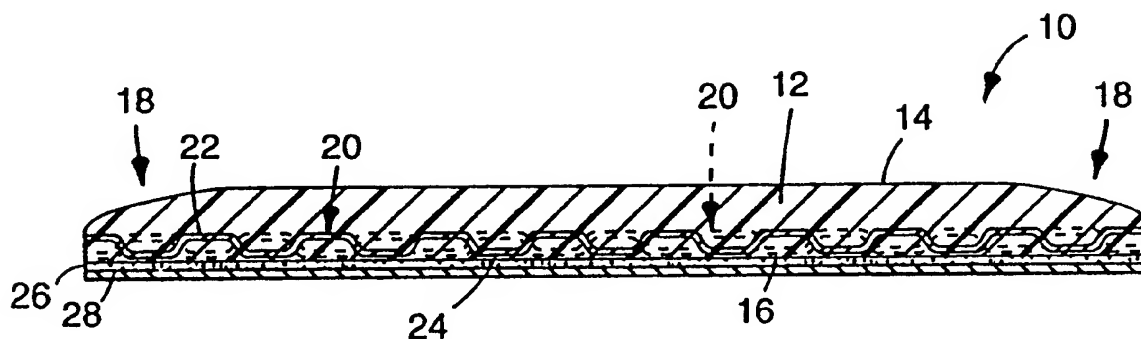




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/US93/12199 <b>(22) International Filing Date:</b> 14 December 1993 (14.12.93)  <b>(30) Priority Data:</b> P 42 42 768.1      17 December 1992 (17.12.92)      DE  <b>(71) Applicant:</b> MINNESOTA MINING AND MANUFACTURING COMPANY [US/US]; 3M Center, P.O. Box 33427, Saint Paul, MN 55133-3427 (US).  <b>(72) Inventor:</b> SCHAUFLE, Ranier, K.; P.O. Box 33427, Saint Paul, MN 55133-3427 (US).  <b>(74) Agents:</b> SKOLNICK, Steven, E. et al.; Office of Intellectual Property Counsel, Minnesota Mining and Manufacturing Company, P.O. Box 33427, Saint Paul, MN 55133-3427 (US).		<b>(81) Designated States:</b> CA, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

**(54) Title:** DECORATIVE ELEMENT**(57) Abstract**

A decorative element (10) comprises a layer of a fibrous material (20) having two opposed surfaces, at least one of which is a structured surface. The fibrous material layer is embedded in a transparent layer (12) that encloses both surfaces of the fibrous material layer. At least one of the boundary surfaces (14) of the transparent layer is arranged at a distance from the structured surface layer of fibrous material. The other boundary surface of the transparent layer is provided with means for mounting the decorative element to the surface.

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## DECORATIVE ELEMENT

BACKGROUND OF THE INVENTIONField of the Invention

10 In a broad aspect, this invention is directed to a decorative element for attachment to objects and surfaces, especially motor vehicles, ships and furniture.

15 Description of the Related Art

Decorative elements formed as ornamental strips or thin films and made from either rigid or flexible materials are known in many embodiments. U.S. Patent Nos. 4,643,790 (Waugh et al.), 4,612,075 (Waugh et  
20 al.), 4,560,596 (Coscia) and 4,446,179 (Waugh) describe decorative elements comprising a substantially flat layer with a decorative design on one surface. The flat layer can be a metal (e.g., aluminum) foil, a plastic (e.g., polyester or polyvinyl chloride) foil, a  
25 metallized plastic foil, a paper backed foil, or an adhesive. The decorative design is usually printed, silk screened or painted. Conventionally, the decorative surface is substantially two-dimensional (i.e., it is relatively flat) although embossed  
30 patterns are mentioned in the patents.

The decorative surface usually has a of transparent, protective material, e.g. polyurethane, applied thereover. Sometimes the transparent layer has curved or radiused edges to provide a lens effect that  
35 enhances the appearance of the underlying decorative design. The outer surface of the transparent layer does not abut the decorative surface and provides the viewing surface for the decorative element. U.S.

Patent No: 4,708,894 (Mabuchi et al.) discloses various materials for the transparent layer.

U.S. Patent No. 4,911,959 (Miyakawa) discloses an ornamental band comprising an arcuate decorative  
5 surface and an overlying arcuate transparent layer.

European Patent Publication No. 0,381,856 (Yaver) discloses a multi-layered, flexible decorative strip comprising an elongated transparent or translucent plastic core. The bottom surface of the core is  
10 covered with an opaque layer and an adhesive layer. The top surface of the core has a thin covering of a metal having a mirror-like appearance with selected portions removed so that the pattern of the underlying opaque layer is revealed. A transparent plastic  
15 overlay is formed over the top covering of metal. The overlay has radiused edges to give enhanced depth of vision to the trip strip. However, manufacture of this decorative strip is relatively complicated, involving a large number of process steps.

20 European Patent Publication No. 0,381,889 (Keys) discloses a flexible laminate strip comprising a substrate consisting of a plurality of clips arranged transversely to the longitudinal direction of the strip. The clips are connected to each other by  
25 parallel, individual fibers oriented in the longitudinal direction of the strip. The interstices between the transverse clips and the longitudinal fibers are filled with an adhesive potting laminate to provide a smooth, continuous outer layer. The clips  
30 and fibers reportedly permit the strip to be bent both in the longitudinal and the lateral directions.

#### SUMMARY OF THE INVENTION

In a broad aspect, this invention provides a  
35 decorative element suitable for attachment to objects and surfaces, especially motor vehicles, ships and furniture. The decorative elements of the invention

can be easily manufactured from commonly used materials and are optically attractive.

In order to achieve these objectives, the invention, in one embodiment, provides a decorative  
5 element comprising a transparent layer having two opposed boundary surfaces and a layer of fibrous material embedded in the transparent layer. The distance between the two boundary surfaces is greater than the thickness of the fibrous material. One  
10 surface (either upper or lower) of the fibrous material carries a structure that is determined by the weaving pattern. The fibrous material is embedded in the transparent layer such that the structured surface is distanced from at least one of the boundary surfaces of  
15 the transparent layer. It is this boundary surface of the transparent layer that forms the viewing surface for the decorative element. The other boundary surface of the transparent layer (whose distance to the layer of fibrous material is considerably smaller and in the  
20 extreme case is negligible), faces the object or the surface to be decorated when the decorative element is mounted thereto.

In an alternative embodiment, the invention is directed to a decorative element comprising a layer of  
25 fibrous material that is provided with at least one structured surface. The structured surface has a transparent layer arranged thereon which completely fills the structure of the surface. The decorative element can be secured to the object or surface to be  
30 decorated by an adhesive layer or other fastening means that is provided on the fibrous material layer surface that faces away from the transparent layer. The layer of fibrous material may be embedded in both the transparent layer and the adhesive layer, in which  
35 event the boundary between these two layers extends through the fibrous material because of its permeability.

In both embodiments, the decorative element includes a visible structured surface that is embedded in or filled by the material of the transparent layer. The outer or exterior surface of the transparent layer is directed toward the viewer, is spaced from the structured surface of the fibrous material, and optically enhances the three-dimensional appearance of the structured surface. Additionally, the transparent layer, because of its capacity to reflect and refract light, lends a certain luster or brilliance to the fibrous material. This is especially the case when the fibrous material is formed of fibers such as carbon, aramid, polyamide, metal, or glass.

Single fibers can be collected in fiber bundles to form the material. In each bundle, the fibers can be oriented in parallel or can be twisted. Alternatively, a wire mesh may be used as the fibrous material. (A "fibrous material" as used herein refers to an arrangement of intersecting, usually orthogonally, fibers, strands, elements, etc.)

Depending on the viewing angle, an observer receives different optical impressions of the structured surface. The optical effect also depends on the thickness and curvature of the transparent layer. All of these factors contribute to the attractive optical design of the decorative elements of the invention.

The decorative elements of the invention are made from a widely used starting product, i.e. the layer of fibrous material. These materials are available in the form of rolls of yard ware and are normally used to manufacture fiber-reinforced structural components. The invention provides a new field of use for these fibrous materials, i.e. the use of mats or layers thereof for decorative elements. The layer of fibrous material can be continuous or discontinuous. That is, it can comprise a single continuous layer or a

plurality of adjacent, separated zones. The fibrous material can be arranged in a plurality of stacked or overlapping layers each of which may be independently continuous or discontinuous. Individual elements of a discontinuous layer of fibrous material that are arranged in a single plane are preferably applied onto a carrier, e.g. a polyester film, and the transparent layer is applied over both the fibrous material and the free areas of the carrier. The elements of the fibrous material layer can have any desired shape, particularly the shape of letters, numbers, symbols, or pictograms.

To maximize the optically enhancing properties of the transparent layer, the structure of the fibrous material should be very fine in relation to the size (width and length) of the decorative element.

Accordingly, in the case of a large planar decorative element, the fibrous material can be less finely structured than if the decorative element is a narrow, elongated strip. The decorative elements of the invention can have any desired shape and size, being limited only by the shape and size of the object or surface to be decorated. Thus, the decorative elements can be ellipsoidal, circular, rectangular, triangular, or a narrow, elongated strip.

The decorative elements of the invention can be used both for interior and exterior decoration. In the latter applications, the transparent layer should be provided with additives for increasing the weather resistance of the decorative element and particularly for maintaining the transparency of the transparent layer over the life of the decorated object or surface.

Suitably, the transparent layer has a thickness of about a few millimeters (mm), preferably about 2 mm and most preferably about 2.2 mm, while the layer of fibrous material has a thickness of about a few tenths of a millimeter, preferably ranging from 0.1 to 0.4 mm. The layer of fibrous material is enclosed by the

material of the transparent layer such that the outer surface facing the viewer and the upper surface of the layer of fibrous material facing the viewer are spaced apart by a distance of about a few millimeters, preferably about 1.5 mm.

In an advantageous embodiment of the invention, the transparent layer comprises a curable polymer which preferably is flexible after curing. Because of the flexibility of the decorative element (that is, both the layer of fibrous material and the transparent layer are flexible), the decorative element can be applied to contoured surfaces. Preferably, the transparent layer is a one- or multi-component elastomeric acrylic or polyurethane material that can be cured, e.g. by heating, UV radiation, RF heating, or by drying in ambient air. Further, the transparent layer can have a curved or lens shape on its outer surface oriented toward the viewer. Alternatively, this curvature can be formed only at the edges, the remaining regions of the outer surface being planar. The curvature is generated preferably by the surface tension of the viscous (when applied) transparent material.

The material for the transparent layer is e.g. a polyurethane obtained as the reaction product of a polycaprolactam triol and an aliphatic diisocyanate-polycaprolactam diol adduct. If a shock-resistant polyurethane is desired, it is preferably obtained as the reaction product of polypropylene glycol and an aliphatic diisocyanate. Preferably, the transparent layer is a relatively soft, flexible, weather-resistant, non-yellowing, wear-resistant and shock-resistant polyurethane having a Shore D hardness in the range of about 10 to 80, more preferably between about 45 and 65. In general, many of the known polyurethanes derived from polyalcohols and polyisocyanates can be used. It is advantageous to use the reaction product of (A) a mixture of a polyester glycol and a



polypropylene triol having a low or medium molecular weight, and (B) an aliphatic diisocyanate polypropylene triol adduct.

Other transparent materials, such as acrylic or epoxy resins, and blends such as polyurethane/acrylic blends and polyurethane/epoxy blends can be used as well. These materials should be pourable resins whose mixing viscosity at the processing temperature is less than 1000 mPas. Also useful as the transparent layer are the materials (including blends) mentioned in U.S. Patent No. 4,708,894 (Mabuchi).

Suitably, the material for the transparent layer is applied to the fibrous material layer by coating, spraying or extrusion. Prior to curing, the transparent material preferably has a viscosity such that it will penetrate the layer of fibrous material and will completely wet and fill the structured surface that faces the viewer. To facilitate fastening the decorative element to an object or surface, it is desirable for both the upper and lower surfaces of the decorative element to be smooth. This can be achieved if the material for the transparent layer completely penetrates the layer of fibrous material and, as a result, forms both surfaces of the decorative article (other than a later applied adhesive layer). That is, the transparent material fully encapsulates the layer of fibrous material.

Preferably, the surface of the transparent layer or the surface of the layer of fibrous material that faces away from the viewer is provided with an adhesive, particularly a pressure-sensitive adhesive (PSA) such as an acrylate PSA, for adhesively attaching the decorative element to the object or the surface to be decorated. The adhesive may comprise an adhesive transfer tape. The adhesive layer is typically protected with an easily removable release liner.

In another variant of the invention, the lower side of the transparent layer is adhesively attached to a mounting frame such as a plastic bezel or a plastic molding, the bottom surface of which carries an adhesive for attaching the frame to the object or the surface to be decorated.

There are also other techniques for fastening the transparent layer, the layer of fibrous material or the mounting frame to the object or surface, e.g. mechanical fasteners such as clamps and clips.

The layer of fibrous material preferably comprises intersecting warp and weft fibers. The intersecting fibers can be individual fibers or bundles of individual fibers. The individual fibers in a bundle can be twisted although it is preferred that they extend in parallel without being twisted. The individual fibers may have a diameter of about a few microns ( $\mu\text{m}$ ), preferably 4 to 14  $\mu\text{m}$ , with several hundred such individual fibers being combined to provide a warp or a weft fiber bundle. Layers, mats or panels of fibrous material comprising carbon, aramid, polyamide, metal or glass fibers are commercially available. The fibrous material can also be a flexible wire mesh.

In one aspect, the decorative element of the invention is distinguished by allowing for a simple manufacturing process. Known commercially available materials may be used for the fibrous material layer and the transparent layer. The optically appealing outward appearance of the decorative element of the invention can be achieved merely with the layer of fibrous material and the transparent layer which can encapsulate the layer of fibrous material. No further layers are necessary for obtaining the desired optical effects. The decorative elements of the invention require neither a metal layer nor machining the fibrous material or the transparent layer. To attach the

decorative element, it is merely required that the lower side of the decorative element be coated with an adhesive although other fastening means may be used.

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BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments of the invention will be described hereunder with reference to the following drawings in which similar reference numerals designate like or analogous components.

10        Fig. 1        is a cross-section through a planar decorative element according to a first embodiment of the invention without a frame, wherein the structure of the fibrous material layer is  
15                    overaccentuated for illustrational purposes;

          Fig. 2        is a top plan view of Fig. 1 with a transparent layer thereof removed to  
20                    show the structure of the underlying fibrous material; and

          Fig. 3        is a cross-section through a decorative element comprising a frame according to  
25                    a second embodiment of the invention, wherein the structure of the fibrous material is again overaccentuated for illustrational purposes.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to the drawings, FIG. 1 is a cross-sectional view of a first embodiment of a decorative element according to the invention. Decorative element 5 10, provided as a multi-layered article, comprises a transparent layer 12 of, for example, polyurethane whose thickness is defined by the distance between its two opposed boundary surfaces 14 and 16. Boundary surface 14 forms the outer or exterior surface of 10 decorative element 10 and faces an observer thereof, while boundary surface 16 faces away from the observer. Lateral boundary edge 18 of transparent layer 12 is radiused in the manner of a lens. This curvature is generated due to surface stresses inherent in the 15 material of the transparent layer when it is applied although it can be provided by post-machining the transparent layer.

A layer 20 of fibrous material, comprising, for example, carbon fibers, is embedded in transparent 20 layer 12. As is apparent from the drawing figures, the layer of fibrous material is encapsulated by transparent layer 12 although the distance between lower boundary surface 16 and fibrous material 20 may be negligible. Fibrous material layer 20 includes 25 upper and lower structured surfaces 22 and 24, respectively. The distance from upper structured surface 22 to outer boundary surface 14 of transparent layer 12 is considerably greater than the distance between lower structured surface 24 and lower boundary 30 surface 16 of transparent layer 12.

Below transparent layer 12, there is a layer of adhesive 26 such as an adhesive transfer tape, which is applied to lower boundary surface 16 of transparent layer 12. Adhesive layer 26 is covered by a release 35 liner or other removable protective sheet 28.

For manufacturing the decorative element of Fig. 1, there is used e.g. a layer 20 of fibrous material

comprising carbon fibers. The layer of fibrous material includes warp and weft fiber bundles 30 and 32 (see Fig. 2) intersecting and extending at right angles to each other and consisting of several hundred up to several thousand individual fibers. The individual fibers of each fiber bundle extend in parallel to each other. A liquid polyurethane is applied to the layer of fibrous material and penetrates the same thereby encapsulating the fibrous material. The polyurethane is applied in a quantity sufficient to generate a transparent layer having a thickness of about 2.2 mm in the most preferred embodiment. Radiused edges 18 are generated as result of the inherent surface tension of the liquid polyurethane. Alternatively, edges 18 can be post generated by machining transparent layer 12.

The thickness of the layer of fibrous material itself is about 0.4 mm. Below the layer of fibrous material is a thin layer of transparent polyurethane with a thickness of about 0.1 mm to complete the encapsulation of the fibrous material. The distance between upper boundary surface 14 and upper surface 22 of the layer of fibrous material is about 1.6 mm. The adhesive transfer tape is applied to lower boundary surface 16 of transparent layer 12 in a thickness of about 0.1 mm. Release liner 28 has a thickness of about a few tenths of a millimeter.

The polyurethane material for transparent layer 12 must be sufficiently liquid during application that it completely penetrates the layer of fibrous material and entirely fills the structured surface thereof. Subsequently, the polyurethane will be cured by heat or other means. Once cured, the polyurethane is sufficiently flexible that the decorative element is plastically deformable.

The natural sheen of the carbon fibers that comprise the fibrous material layer is greatly enhanced when viewed through transparent layer 12. Due to

reflection from boundary surface 14 of transparent layer 12 and upper surface 22 of the layer of fibrous material as well as the refraction of the light, an optically appealing impression of the decorative element 10 that is independent of the point of view is obtained. The thickness of the transparent layer 12 in the region above the layer of fibrous material also contributes to the optical effect. A thickness of about 1 mm to 2 mm, preferably 1.5 mm to 1.6 mm, yields the most favorable optical effect. Radiused edges 18 cause an additional lens effect that is optically appealing.

If instead of a planar film-shaped decorative element according to FIGS. 1 and 2, there is formed a strip shaped decorative element, the entire outer boundary surface 14 of transparent layer 12 has a curved configuration which depends on the width of the strip.

FIG. 3 shows another embodiment, more specifically a planar film-shaped decorative element 40. Components of decorative element 40 that correspond to those of decorative element 10 are designated by the same reference numerals.

In decorative element 40, transparent layer 12 is arranged only above fibrous material layer 20, the upper structured surface 22 of which is completely filled by the transparent material. Adhesive layer 26 fills structured surface 24 of layer 20. Thus, the fibrous material layer 20 is enclosed on its upper and lower surfaces by transparent layer 12 and adhesive layer 26, respectively. Since both the transparent material and the adhesive penetrate the porous fibrous material layer, the boundary between transparent layer 12 and adhesive layer 26 extends (horizontally) through the layer of fibrous material.

Decorative element 40 of further comprises a frame, holding or carrier element 42 such as a bezel or

molding that is preferably made of plastic.  
Transparent layer 12 is adhered with adhesive layer 26  
to frame 42. Frame 42 has an upwardly projecting edge  
44 formed thereon which encloses transparent layer 12  
5 on the sides. Frame 42 has its lower side provided  
with an adhesive layer 46 which is covered and  
protected by a release liner 48. By removing release  
liner 48, adhesive layer 46 is exposed so that  
decorative element 40 can be adhered to the object or  
10 surface to be decorated.

Numerous variations and modifications are possible  
within the scope of the foregoing specification and  
drawings without departing from the spirit of the  
invention which is defined by the accompanying claims.

CLAIMS

## WHAT IS CLAIMED IS:

1. A decorative element for attachment to a surface comprising:
  - a. a layer of a fibrous material having two opposed surfaces at least one of which is a structured surface; and
  - b. a transparent layer having two boundary surfaces, the distance between said boundary surfaces being greater than the thickness of the layer of fibrous material, said transparent layer having the layer of fibrous material embedded therein such that the at least one structured surface thereof is arranged at a distance from at least one of the two boundary surfaces of the transparent layer, and further wherein the other boundary surface includes means for mounting the decorative element to the surface.
2. A decorative element according to claim 1, wherein the transparent layer is a flexible, cured, synthetic polymer.
3. A decorative element according to claim 2, wherein the viscosity of the polymer prior to curing is selected such that the polymer penetrates the layer of fibrous material and wets the at least one structured surface.
4. A decorative element according to any one of claims 1 to 3, wherein the layer of fibrous material comprises individual bundles of fibers formed of a material selected from the group consisting of carbon, aramid, polyamide, metal and glass.
5. A decorative element according to any one of claims 1 to 3, wherein the layer of fibrous material is a wire mesh.



6. A decorative element according to any one of claims 1 to 5, wherein the means for mounting the decorative element to the surface is a layer of adhesive.

7. A decorative element according to any one of claims 1 to 6, wherein the decorative element is fastened to a frame that includes an adhesive layer for mounting the frame to another surface.

8. A decorative element according to any one of claims 1 to 7, wherein the at least one boundary surface of the transparent layer is radiused.

9. A decorative element for attachment to a surface comprising:

- a. a layer of fibrous material having two opposed surfaces at least one of which is a structured surface;
- b. a transparent layer that fills the at least one structured surface of the layer of fibrous material so as to provide a transparent layer boundary surface that is arranged at a distance from the structured surface, the fibrous material layer being partially embedded in the transparent layer; and
- c. means for fastening the decorative element to the surface.

10. A decorative element according to claim 9, wherein the fastening means is an adhesive layer on the surface of the layer of fibrous material averted from transparent layer.

11. A decorative element according to claim 9 or 10, wherein the transparent layer is a flexible, cured, synthetic polymer.

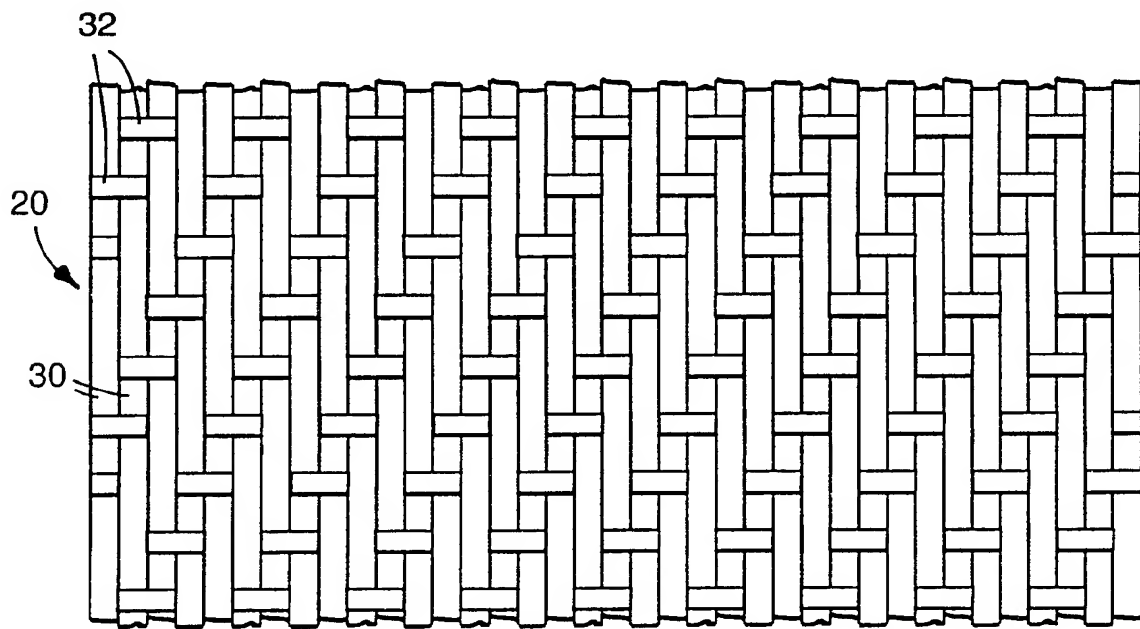
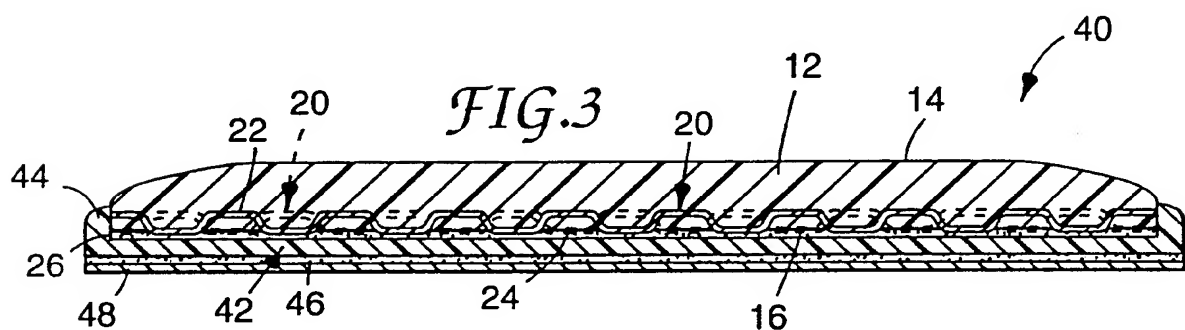
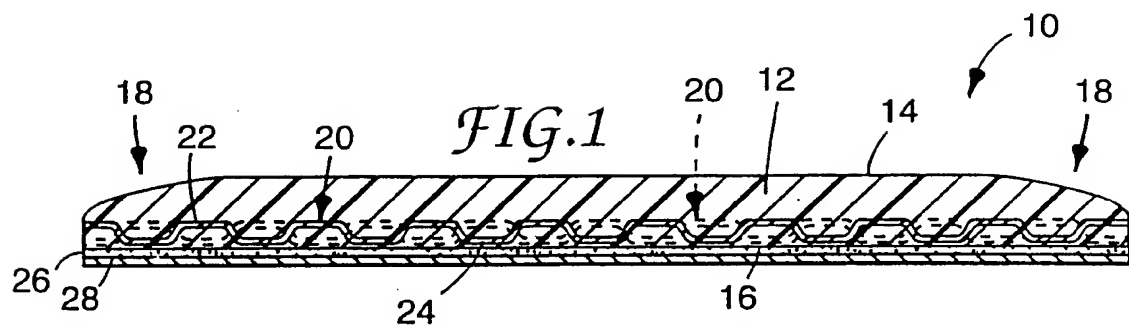
12. A decorative element according to claim 11, wherein the viscosity of the polymer prior to curing is selected such that polymer penetrates the layer of fibrous material and wets the at least one structured surface.

13. A decorative element according to any one of claims 9 to 11, wherein the layer of fibrous material comprises individual bundles of fibers formed of a material selected from the group consisting of carbon, aramid, polyamide, metal and glass.

14. A decorative element according to any one of claims 9 to 11, wherein the layer of fibrous material is a wire mesh.

15. A decorative element according to any one of claims 10 to 15, wherein the decorative element is fastened to a frame that includes an adhesive layer for mounting the frame to another surface.

16. A decorative element according to any one of claims 10 to 16, wherein the transparent layer boundary surface is radiused.



*FIG. 2*

## INTERNATIONAL SEARCH REPORT

International App. No

PCT/US 93/12199

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 5 B44C5/04 B60R13/04 B29C67/14

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 5 B29C B44C B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,91 07281 (CARBON FIBER PRODUCTS) 30 May 1991 see page 9, paragraph 2 ---	1-16
X	GB,A,2 049 002 (GIBBONS) 17 December 1980 ---	1-16
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A	EP,A,0 266 109 (REXHAM CORP.) 4 May 1988 ---	1,9
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

16 March 1994

Date of mailing of the international search report

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# INTERNATIONAL SEARCH REPORT

International Appl. No.

PCT/US 93/12199

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

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PCT/US 93/12199

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